

INTEGRATION ISSUES

JUNE 3, 1999

PIXEL MECHANICS PRAGUE

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PROPOSALS FOR APPROVAL THIS SUMMER

- **ASSEMBLY OF B-LAYER USING RAILS IN PIXEL DETECTOR AND FORWARD**
 - PROPOSAL
 - MATERIAL IMPLICATIONS
 - STRUCTURAL IMPLICATIONS
- **SERVICES OUT ONE SIDE-MAKES INSTALLATION EASIER**
 - PROPOSAL AND VARIATIONS
 - MATERIAL IMPLICATIONS
 - TRADE OFF AGAINST COOL-ABILITY AND VOLTAGE DROP
- **THERMAL BARRIER THROUGH PIXEL VOLUME**
 - DESCRIPTION OF PROBLEM
 - PROPOSAL
 - BENEFITS
 - RISKS
- **FORCES FROM SERVICES**
 - COOLING PIPES/CABLES
 - STRAIN RELIEF TO INNER DETECTOR INTEGRATION STRUCTURE
- **SCT INTERFACE**
 - DOCUMENT IN PROGRESS WITH ERIC PERRIN
 - LOOKING AT COMMON ASSEMBLY TOOLING WITH SCT
 - ASSEMBLY SCENARIO INFLUENCES DESIGN OF SUPPORTS

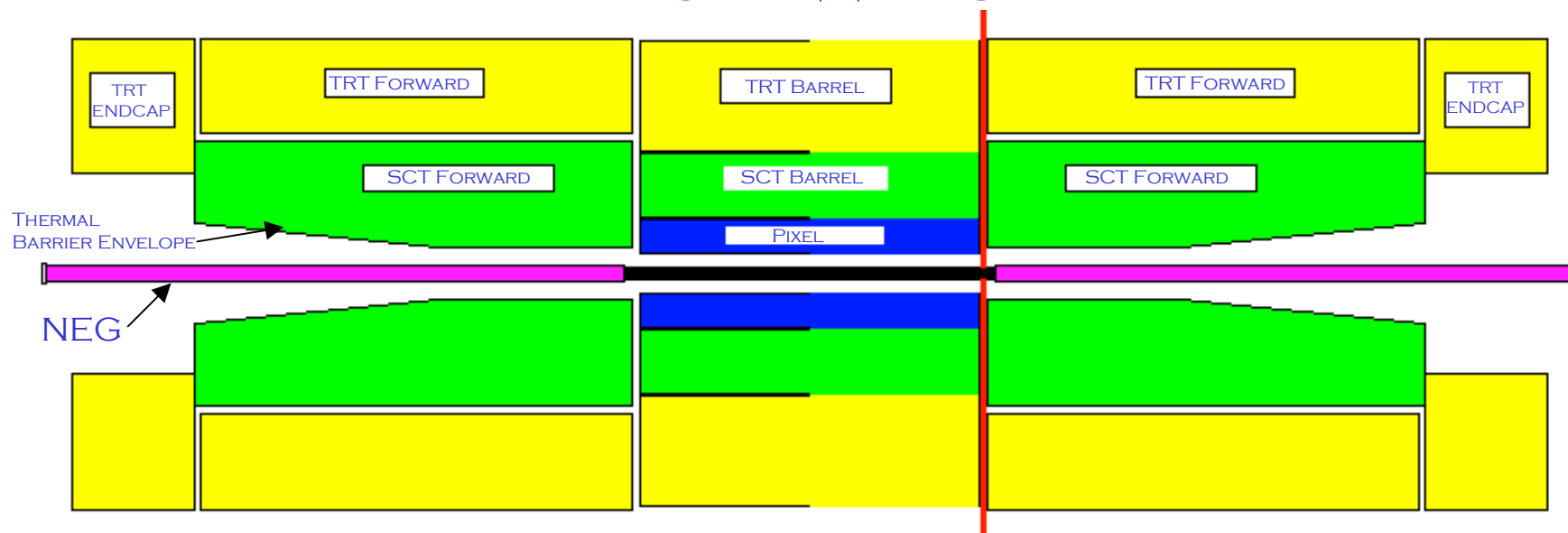
PROPOSAL TO INSTALL RAILS IN PIXEL DETECTOR

- **EXPLANATION FOR PROPOSAL**
- **ROUGH INSTALLATION SCENARIO**
 - BRIEF OVERVIEW ONLY
- **SUGGESTED SUPPORT LOCATIONS OF RAILS**
 - RAIL SECTIONS
 - SERVICE ROUTING AND SUPPORTS
- **LOADING PROFILE FOR RAILS**
 - INSTALLATION LOADS
 - LOADS IN OPERATION
- **CROSS SECTION AND MASS ESTIMATE**
 - DEFLECTION ANALYSIS ASSUMPTIONS
 - CROSS-SECTION OF RAILS + MATERIAL ESTIMATE

REASONING FOR NEW INSTALLATION SCENARIO

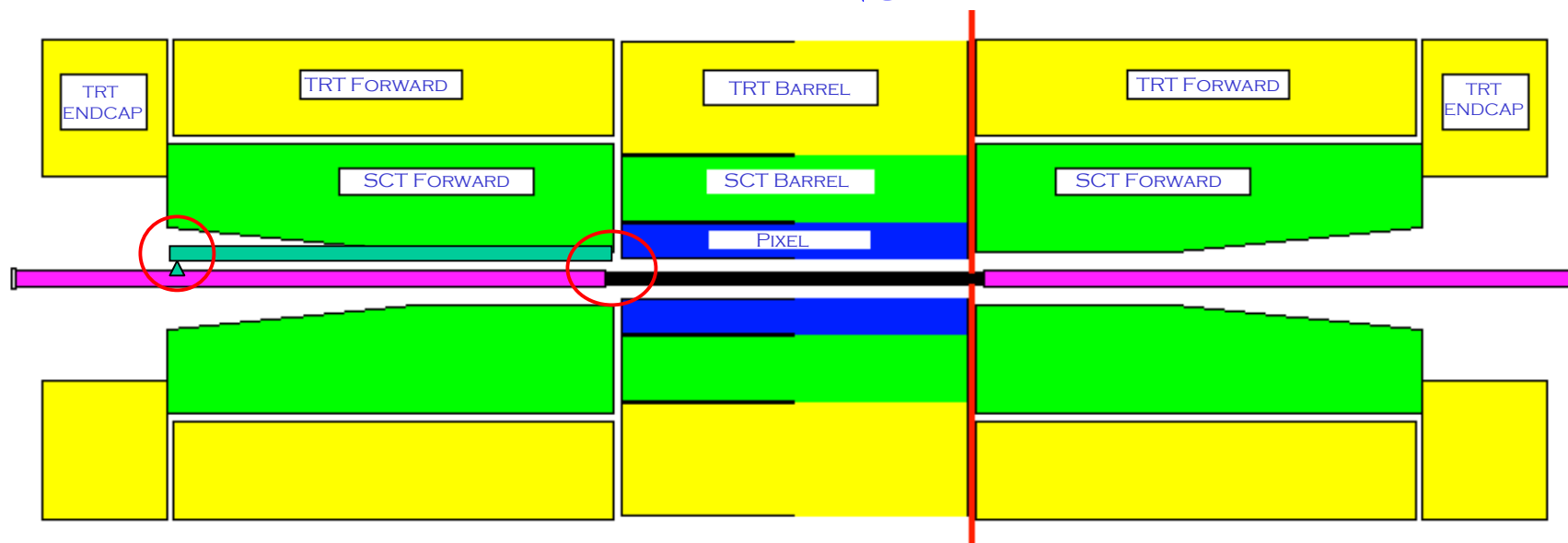
- **INSTALLATION AND REMOVAL OF TOOLING PRESENTS A RISK OF DAMAGE EACH TIME IT IS DONE-TOOLING WHICH MUST PENETRATE PIXEL VOLUME FROM 3M AWAY INSERTED THROUGH AND CLOSE TO LAYER 1**
- **PERMANENT RAILS WITHIN PIXEL VOLUME ALLOWS FOR ACCURATE ALIGNMENT OF RAILS RELATIVE TO MOUNT FEATURES**
- **PERMANENT RAILS REDUCE THE INSTALLATION TIME MINIMIZING WARM TIME**
- **OLD INSTALLATION SCENARIO REQUIRED TOOLING marginally consistent with overall constraints, expensive, risky and time consuming-EFFORT WAS BETTER SPENT ADJUSTING CONSTRAINTS**
- **IMPACT ON NEIGHBORING SYSTEMS IS MINIMIZED REDUCING TIME CONSTANT FOR PROGRESS, DECOUPLING SCHEDULES**
- **SERVICES OUT BOTH SIDES REQUIRES AMAZING EFFORT TO ACHIEVE, MAKES HANDLING OF B-LAYER DURING ASSEMBLY VERY UNWIELDY, REQUIRES SPECIAL TOOLING TO EXPAND SERVICES AFTER PASSING THROUGH DETECTOR**

PIXEL DETECTOR INSTALLATION



- **DETECTOR WARMED UP, AIR PURGED**
- **THERMAL BARRIER OPENED, RAILS INSTALLED**
- **B-LAYER SANS SERVICES ATTACHED TO RAILS**
- **SERVICES ATTACHED TO SUPPORTS**
- **SERVICES TERMINATED TO B-LAYER**
- **WHOLE RIG PUSHED IN UNTIL LOAD TRANSFERRED TO SUPPORT STRUCTURE(S)**
- **RAILS REMOVED**
- **SERVICES TERMINATED TO PPF'**

PIXEL DETECTOR RAILS



- **INSTALLATION RAILS ARE EASILY SUPPORTED AT ENDS OF SCT FORWARD, BUT NOT MIDDLE**
- **B-LAYER HUNG FROM TOP GUIDED BY BOTTOM—SIMILAR TO ALEPH INSTALLATION**
- **SERVICES EITHER PERMANENTLY SUPPORTED BY RAIL IN FORWARD REGION OR SUPPORTS MUST BE PROVIDED BY SCT**
- **RAIL IN FORWARD IS EQUIVALENT TO 25MM TUBE WITH 1 MM WALL**
- **RAIL IN PIXEL IS EQUIVALENT TO 20MM TUBE WITH 0.5MM WALL**

SUPPORT CONDITION CHANGE

- OLD SUPPORT CONDITION WAS OVER CONSTRAINED IS ***VERY*** OVER CONSTRAINED IF SHELLS ARE FASTENED TOGETHER
- ALIGNMENT FROM END TO END IN BOTH PHI AND XY OF ALL MOUNTING POINTS WAS NECESSARY FOR MOUNTING TO BE SUCCESSFUL-THIS IS RISKY WITH NO ACCESS
- FREQUENCY RESPONSE WILL LIKELY BE DEGRADED, AS KINEMATIC AND PSEUDO-KINEMATIC SUPPORTS ARE ALWAYS LESS STIFF
- THIS SHOULD BE ACCEPTABLE FOR THE B-LAYER, BUT I DO NOT RECOMMEND THIS FOR THE OTHER LAYERS WHERE ACCESS DURING ASSEMBLY IS AVAILABLE
- RIGIDITY OF REMAINING SUPPORTS SHOULD BE INCREASED
- B-LAYER STRUCTURE MUST BE RE-DESIGNED

PIXEL DETECTOR

B-LAYER SERVICE ROUTING

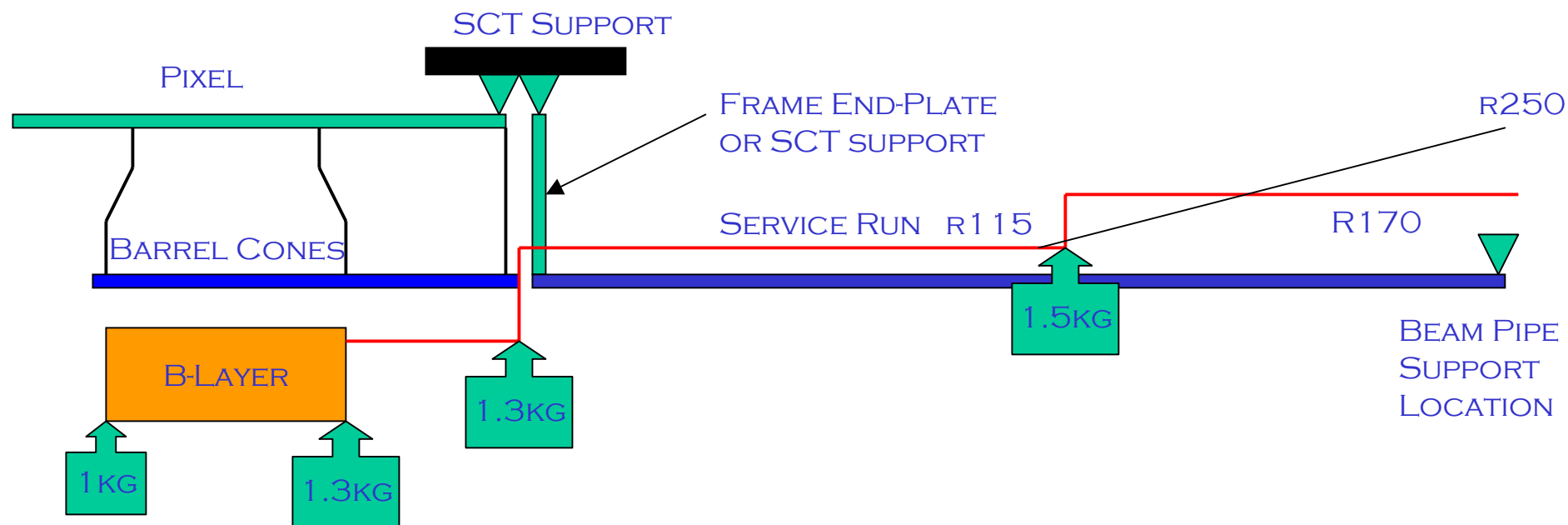
- **COOLING**

- TUBES INCREASE 20% FROM TDR
- POSSIBILITY TO RUN STAVES IN SERIES
 - MAINTAINS CURRENT MATERIAL BUDGET
- CAPILLARY TO FAR SIDE, UNIQUE EXHAUST
 - DOUBLES TUBING MATERIAL

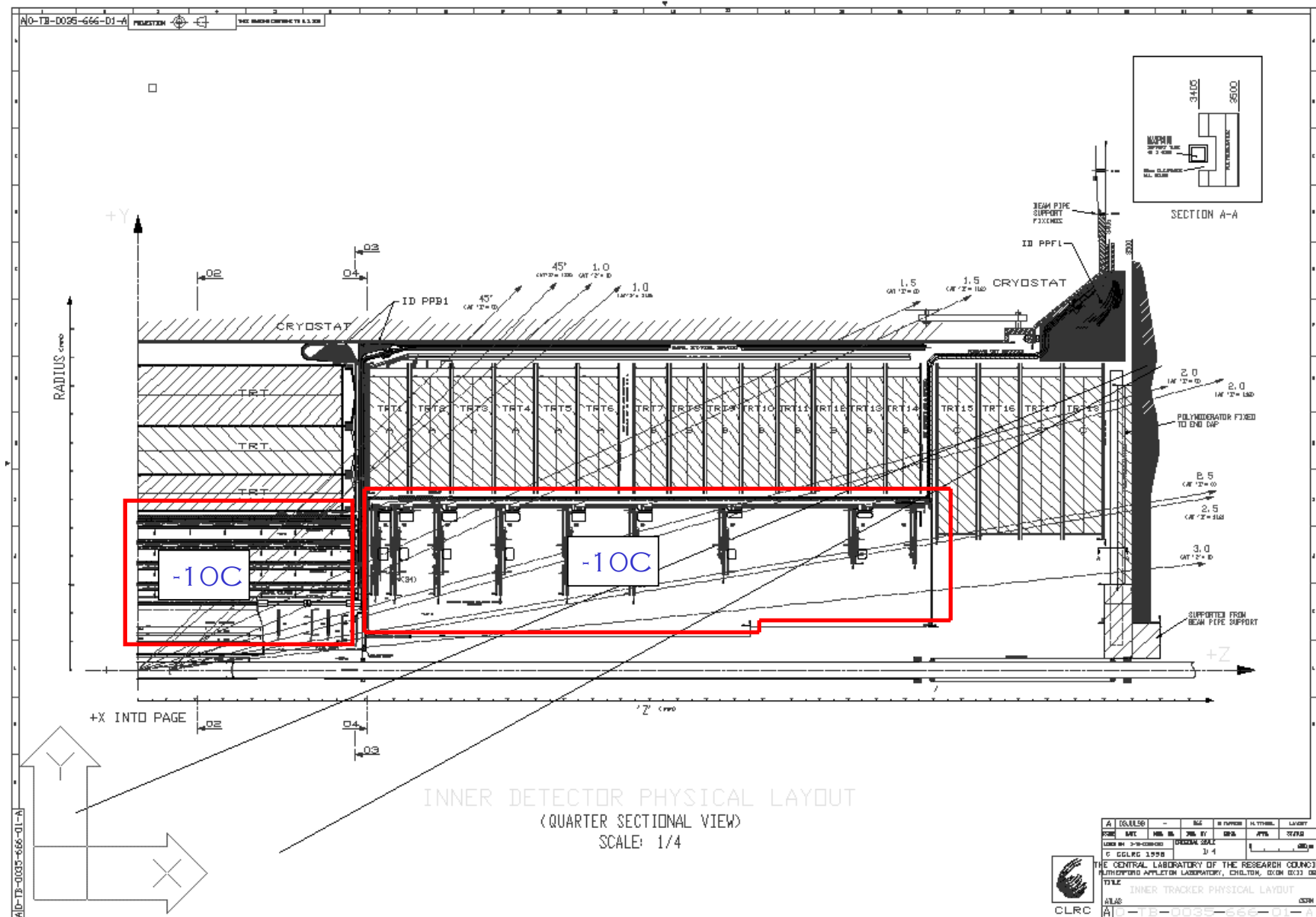
- **POWER**

- STAVE ISSUES
 - NEED TO RESPECT 10MM BEAM PIPE STAYOUT
- PIGTAIL DESIGN
 - POWER IS HIGHER
 - DROP MAY DOUBLE-BALANCED WITH MATERIAL INCREASE
- TRANSITION FROM TYPE I OR TYPE II
 - WILL COVER MORE TOMORROW

PIXEL DETECTOR LOADS



- **LOADS ESTIMATED ARE A LITTLE BEYOND MAXIMUM**
 - 20 STAVES @75G/ALL SERVICES ONE SIDE-SINGLE STAVE PER EXHAUST
 - CABLES RESIZED FOR POWER INCREASE
- **MAXIMAL SAG IN FORWARD 5MM**
- **MAX IN PIXELS IS 2MM**
- **SAG DURING ENGAGEMENT BECOMES VERY SMALL**
- **SUPPORT OF SERVICES REQUIRES FANOUT RING AT STEP LOCATIONS**



PIXEL DETECTOR THERMAL BARRIER

- **WANT TO REMOVE THERMAL BARRIER**
 - PENETRATION THROUGH STRUCTURE HAS VERY BAD IMPLICATIONS FOR STRUCTURE
 - REALLY NOT POSSIBLE TO SEAL ADEQUATELY
 - LESS MATERIAL
- **MUST SOLVE ANOTHER SEALING PROBLEM**
 - IN LESS CRITICAL AREA
- **RISK IS DETECTOR WARM UP**
 - SCT MUST BE FULLY INVOLVED IN THIS DECISION
 - TRT IS INFLUENCED BY LEAK OF GASSES-BUT THIS IS ALREADY A PROBLEM

PIXEL DETECTOR

FORCES FROM SERVICES

- **BELLOWS**

- ACT AS PISTONS
- 4MM ID EQ. HAS 0.8 NEWTONS PER BAR
- IF ONE PER EXHAUST, THERE IS 5KG RADIAL FORCES

- **CABLES**

- STRAIN RELIEF STRUCTURE 50MM AWAY IN GAP
- ONLY SMALL SPACE AVAILABLE FOR BENDING, BUT SHOULD BE OK
- CANNOT CALCULATE FORCE-NEED TO MAKE PHYSICAL MODEL TO TEST
- THIS CAN BE DONE WITH CABLE PROTOTYPES, AND ON SERVICE MOCK-UP BEING BUILT AT RAL

- **FIBER OPTICS**

- FORCES ON DETECTOR NEGLIGIBLE, BUT FORCES ON FIBER MUST BE AVOIDED
- 20MM RADIUS MIN-FAILURE RATE GOES AS 20TH POWER OF $1/R$!
- MAY NEED TO INCLUDE METAL SLEEVES AT EXIT TO GUARANTEE BEND RADIUS- INDUSTRIAL SOLUTION
- UNFORESEEN STRUCTURE MAY EXERT FORCES-NEED TO WORK ON THIS

PIXEL DETECTOR

SCT INTERFACE DOCUMENT

- **WORK IN PROGRESS**

- ERIC PERRIN WORKING ON SCT PART

- STRUCTURAL INTERFACE TO INTERLINK
 - POSSIBLE INTEGRATION OF PIXEL ASSEMBLY TOOLING AND SCT BARREL INSERTION
 - FIRST GO THROUGH SEQUENCE OF ASSEMBLY-INCLUDES X-RAY SURVEY-TIES INTO WORK DONE ALREADY FOR SCT

- E! (NOT EP)

- WORKING TO GET STRUCTURES ANALYZED TOGETHER AT RAL
 - STRUCTURAL INTERFACE
 - ENVELOPE DEFINITION
 - ENVIRONMENT
 - FAILURE SCENARIOS

- **WILL ACT AS EDITOR UNTIL COMPLETED**

- SOLICITATION OF OTHER AUTHORS
 - MARCO WILL FOLLOW THROUGH ON APPROVAL PHASE